harvest. The figures just cited are obtained from averages over the whole 12-year period. The closest prediction of the Meteorological Department was within 1,000,000 bushels of the actual yield for the area studied, which totaled 126,600,000 bushels. This prediction was made in March, 1923, for the crop to be harvested in April. The closest official estimate of the Department of Agriculture was within 333,000 bushels of the actual yield, and this prediction was made in April, 1916. The greatest error made by the Meteorological Department during the 12-year period was that of their March, 1922 prediction, which was 27,500,000 bushels too low. But this error was exceeded by the official Department of Agriculture prediction made the middle of April, 1923, which was 37,400,000 bushels too high. Three of the 24 predictions made by the Meteorological Department showed a departure opposite that to the actual, while none of the 12 official Agricultural Department predictions showed such an error.

Forecasts for area sown made by the Meteorological Department and the Official Forecasting Agricultural Department for the same period of years show the following errors:

	Per cent
Average Meteorological Department error	4. 5
Average Official error	5. 2
Greatest Meteorological Department error	11. 7
Greatest Official error	8. 7
Least Meteorological Department error	. 9
Least Official error	1. 9

Two of the 12 predictions on area sown made by the Meteorological Department showed a departure opposite that of the actual, while none of the 12 official predictions showed such an error. The Meteorological Department predictions were made the last of October, while those of the Official Department came out the last of January.

These errors [while somewhat greater than those of some investigations of the United States Weather Bureau in Weather and Crop Studies of this Country] are small enough to indicate that the work of the Indian Meteorological Department is of significant value to Indian agriculture. Probably its greatest value comes through the fact that these predictions are made known so much earlier than the official estimates. Doubtless when other meteorological factors such as frost frequency, distribution of rainfall, cloud proportion, dust storms, and direction of prevailing wind are included by the Indian Meteorological Department in their corrections, their estimates will much more closely approach the actual.—*Earl B. Shaw*, Clark University.

E. KIDSON ON AVERAGE ANNUAL RAINFALL IN NEW ZEALAND FOR THE PERIOD 1891 TO 1925 [1]

The distribution of precipitation in New Zealand is affected by topography and the prevailing westerly winds in such manner that most rainfall occurs on the west sides of the islands. Rain shadows are noticeable in the central portions. The east shore has a higher precipitation than the central area on account of onshore winds. However, there is a tendency for the lowest rainfall to occur near the coast in the neighborhood of Cape Campbell. The highest precipitation is in the western highlands of both islands, over 200 inches, the lowest in the southeastern lowland of South Island, under 15 inches. The number of rainy days is practically nowhere excessive.

The accompanying five maps showing in detail the distribution of stations, relief, average number of rainy days, and mean annual rainfall of the Islands add greatly to the value of the work.—*Sigismond R. Diettrich.*

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1930

Three papers of meteorological interest presented at the Bristol meeting, 1930, are noted in the report of the meeting, just published.[2]

A discussion on The Meteorological Relations of Atmospherics, by R. A. Watson Watt, E. V. Appleton, R. Bureau, and M. A. Giblett, is briefly outlined (p. 293). Mr. Watt outlined the present knowledge of the subject; Mr. Bureau described the recording of the number of atmospherics per minute. Professor Appleton compared extraterrestrial with terrestrial sources, concluding that—

The thunderstorm mechanism seems to be a more likely source than the extraterrestrial sources proposed.

Attention is called to the experimental fact found by Appleton, Watt, and Herd that, for atmospherics of local origin, negative electrostatic field changes are about 1.5 times as frequent at positive, while for those of distant origin positive radiation field changes are about 1.5 times as freqeunt as negative. The possible significance of this is briefly discussed.

Mr. Giblett said that observations of the sources of atmospherics made at the radio research station, Slough, Bucks, at 13.00 G.M.T. daily had been plotted and studied in connection with the current synoptic charts.

The abstracts of two papers on climatic changes follow (p. 349):

Dr. C. E. P. Brooks, Climatic Changes in Historic Times.

It appears probable that there have been during historic times certain periods when the climate of large areas differed appreciably from that of the present century. The conditions are discussed during a number of critical periods, as far as the available evidence permits:

ca. 2200 B. C. Dry in Europe and western Asia. In western and central Europe the rainfall was in places only about half the present amount.

800–400 B. C. Wet and stormy, especially in central Europe.

0–200 A. D. Approaching present conditions.

500–800 A. D. Probably rather dry, especially in central Asia.

1200–1400 A. D. Wet and stormy in northwestern Europe.

1700–1750 A. D. Dry in western Europe.

Prof. A. E. Douglass, Past Changes in Climate in Relation to Settlements in the New World.

The annual rings of trees provide a means of studying certain characters of past climates. In the southwestern parts of the United States showing an annual rainfall of 15 to 25 inches, the rings of the *Pinus ponderosa* give a very effective record of rainfall variations from year to year, increased growth accompanying increased rainfall. Long series of such ring values have been studied and variations have been found related to the 11-year sun-spot cycle.

Since, in the region referred to, the climate is fairly constant over a large area, annual characters in rings may be traced over an extended forest district and thus exact dates may be carried from tree to tree. For example, we can pass from the older central part of a living tree to the outer part of an old building beam in a village 100 miles away, and then from the central part of the latter beam to the outer part of, perhaps, a log from a distant prehistoric ruin. Thus, a chronology of rings and rainfall has been carried back to 700 A. D. But this exact dating of the rings gives also the actual years of cutting the logs provided the outermost rings are still present. Thus, in return for providing material for building a climatic history the archæologists have received the building dates of some 40 prehistoric ruins. The oldest and the largest of the ruins so far dated, is Pueblo Bonito (New Mexico) whose construction period extended from 919 to 1127 A. D. The method can be successfully applied in many parts of the world but not necessarily in all.—*C. F. B.*

[1] Meteorological Branch, Department of Scientific and Industrial Research, Wellington. New Zealand, 1930, pp. 8, 5, maps.

[2] British Association for the Advancement of Science. Report of the Ninety-eighth Meeting (Hundredth Year), Bristol, 1930. September 3–10. London, Office of the British Association, Burlington House, London, W. 1, 1931. 472 pp.